PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS

Serial No.:	**10/535,487**
Inventors/Applicants:	Gerard Vincent Monaghan et. al.
Assignee:	ETX Systems Inc.
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Title:	PROCESS FOR CONVERTING A LIQUID FEED MATERIAL INTO A VAPOR PHASE PRODUCT
Group Art Unit:	1797
Confirmation No.:	3934
Examiner:	Randy Boyer
Entity Status:	Small Entity
Our Docket:	RR-584 PCT/US

TO: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

March 5, 2010

APPELLANT'S BRIEF UNDER 37 C.F.R. §41.37

Sir:

This Appellant's Brief is submitted further to the Notice of Appeal filed on January 5, 2010.

The \$270.00 (small entity) fee required pursuant to 37 CFR §41.20(b)(2), is being paid by credit card accompanying the filing of this brief. Please charge any additional required fees in connection with the filing of this Appellant's Brief, to our Deposit Account No. 18-1743.

1. REAL PARTY IN INTEREST

The real party in interest is the assignee of record, ETX Systems Inc.

2. RELATED APPEALS AND INTERFERENCES (i.e. RELATED PROCEEDINGS)

There are no prior and pending appeals, interferences or judicial proceedings known to the Appellant or the Appellant's legal representative which may be related to, directly affect or be directly affected by or having a bearing on the Board's decision in this Appeal.

3. STATUS OF CLAIMS

Claims 2 - 26 are currently pending in this Application. Claims 2 - 23, 25 and 26 were rejected in the Final Office Action dated October 5, 2009. Claim 24 was objected to as being dependent upon a rejected base claim, but is otherwise considered to be allowable. This Appeal is directed at Claims 2 - 23, 25 and 26.

4. STATUS OF AMENDMENTS

No amendments have been made to the Claims since the issuance of the Final Office Action dated October 5, 2009.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Claim 26 is an independent claim. Claims 2 - 25 all depend directly or indirectly from independent Claim 26. References to the Specification in this Appellant's Brief are references to the Application "as filed" by the Applicant.

The process as claimed in independent Claim 26 is directed at a process for converting a liquid feed material (40) into a vapor phase product (44) comprising the following:

(a) providing a fluid bed (30) comprising solid particles (28) and a fluidizing medium (22), **wherein providing the fluid bed (30) is comprised of introducing the solid particles (28) to the fluid bed (30) at an upstream horizontal position in the fluid bed (30)**, wherein providing the fluid bed (30) is further comprised of introducing the fluidizing medium (22) to the fluid bed (30) so that the fluidizing medium (22) is moving in a substantially vertical fluidizing direction, and wherein the solid particles (28) are at a conversion temperature which is suitable for facilitating the conversion of the liquid feed material (40) to the vapor phase product (44);

(b) moving the solid particles (28) in a substantially horizontal solid transport direction (32) from the upstream horizontal position to a downstream horizontal position;

(c) **introducing the liquid feed material (40) directly to the fluid bed (30), separately from the solid particles (28)** and separately from the fluidizing medium (22), **at a feed zone located between the upstream horizontal position and the downstream horizontal position** in order to facilitate the conversion of the liquid feed material (40) into the vapor phase product (44);

(d) maintaining the solid particles (28) as fluidized solid particles in the feed zone by introducing the fluidizing medium (22) to the fluid bed (30) in the feed zone; and

(e) collecting the vapor phase product (44).

(Page 7, lines 16 - 33; Page 8, lines 13 - 15; Page 8, lines 28 - 34; Page 9, line 28 - Page 10, line 16; Page 11, line 17 - Page 12, line 11; Page 13, line 8 - Page 14, line 14; Page 17, lines 4 - 26; and Figures 1 and 2 of the Application).

Thus, a fluid bed (30) is provided which is defined as comprising the solid particles (28) and the fluidizing medium (22), wherein providing the fluid bed (30) is comprised of

introducing the solid particles (28) to the fluid bed (30) at an upstream horizontal position. Further, the solid particles (28) are moved in the fluid bed (30) in the substantially horizontal solid transport direction (32) from the upstream horizontal position to the downstream horizontal position.

The liquid feed material (40) is introduced **DIRECTLY to the fluid bed (30), SEPARATELY from the solid particles (28)**, at the **feed zone (62)**, wherein the feed zone (62) is located **between** the upstream and downstream horizontal positions.

As described in further detail in the Application at Page 9, line 28 - Page 10, line 2:

> "In a preferred process aspect of the invention, a fluidizing medium such as a gas is introduced into a reactor to fluidize a bed of solid particles such that the fluidizing medium is moving in a substantially vertical fluidizing direction. The solid particles are transported substantially horizontally in a solid transport direction from a solids inlet at an upstream horizontal position in the reactor to a solids outlet at a downstream horizontal position in the reactor, preferably but not necessarily by the force of gravity. **As the solid particles move through the reactor** they are contacted by a liquid feed material comprising a liquid hydrocarbon. The liquid hydrocarbon is introduced into the reactor **at a feed zone** which is located **downstream of the solids inlet**."

Further, referring to Figures 1 and 2, Page 11, line 23 - Page 12, line 3 of the Application states:

> "The fluidizing medium (22) fluidizes solid particles (28) to produce a fluid bed (30). The solid particles (28) in the fluid bed (30) move in a substantially horizontal solid transport direction (32) from a solids inlet (34) at an upstream horizontal position to a solids outlet (36) at a downstream horizontal position. The solid particles (28) are collected in a solid collection apparatus (38) which is associated with the solids outlet (36)."
>
> "A liquid feed material (40) is introduced into the reactor (20) at a feed inlet (42) which is located downstream of the solids inlet (34) so that the feed inlet (42) is between the solids inlet (34) and the solids outlet (36)."

Thus, as shown in Figures 1 and 2 of the Application, the reactor (20) is divided into a number of zones, including a solid feed zone (60) and a liquid feed zone (62), each having a different function (Page 13, lines 10 - 14 of the Application). The liquid feed zone (62) is located

downstream of the solid feed zone (60). Further, the liquid feed material (40) is introduced in the liquid feed zone (62) directly to the fluid bed (30), the fluid bed (30) comprising the solid particles (28) fluidized by the fluidizing medium (22).

In addition, the step of introducing the liquid feed material **directly to the fluid bed** at the feed zone is further defined in dependent Claims 10 - 14. (Page 9, lines 1 - 12; and Page 18, line 13 - Page 20, line 9 of the Application).

Dependent Claim 10 claims wherein the step of introducing the liquid feed material (40) directly to the fluid bed (30) at the feed zone (62) is comprised of **spraying** the liquid feed material (40) so that the liquid feed material (40) contacts the solid particles (28) as droplets.

Dependent Claim 11 claims wherein the liquid feed material (40) is sprayed **within the fluid bed** (30) so that the droplets **penetrate the fluid bed** (30).

Dependent Claim 12 claims wherein the liquid feed material (40) is sprayed so that the droplets contact the solid particles (28) from a spraying direction which is substantially perpendicular to the solid transport direction (32).

Dependent Claim 13 claims wherein the spraying direction is a substantially vertical direction. Dependent Claim 14 claims wherein the spraying direction is substantially opposite to the fluidizing direction (26).

The liquid feed delivery is particularly described in the Application at Page 18, line 13 - Page 19, line 10. In addition, Page 19, lines 31 - 34 of the Application states that "adequate momentum is imparted to the feed droplets to allow some penetration of the liquid feed material (40) into the fluid bed (30)."

Dependent Claim 18 further defines the step of moving the solid particles (28). In particular, Claim 18 claims wherein the solid particles (28) are moved in the solid transport direction at a rate which is significantly larger than a rate of mixing of the solid particles (28) in the solid transport direction (32).

In other words, "the Peclet (Pe) number describing the movement of the solid particles is relatively large so that the movement of the solid particles in the solid transport direction approaches plug-flow" (Page 8, lines 7 - 11; and Page 21, lines 3 - 10 of the Application).

Dependent Claim 22 further defines the "solid particles" (28) In particular, the solid particles (28) are comprised of an amount of a catalyst which is suitable for use in converting the liquid feed material (40) into the vapor phase product (44). (Page 8, lines 3 - 5; and Page 14, lines 24 - 28 of the Application).

Dependent Claim 25 further defines the process as comprising the step of collecting a vaporized fraction (51) of the liquid feed material (40) at a vapor phase product collection location (50) which is adjacent to the feed zone (62). (Page 9, lines 22 - 26 of the Application).

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

In the Final Office Action dated October 5, 2009, the Examiner rejected independent Claim 26 and dependent Claims 2 - 23 and 25 as being unpatentable over U.S. Patent No. 2,717,867 to Jewell et al (Jewell et al), being the sole ground of rejection (the Ground of Rejection).

7. ARGUMENT

It is respectfully submitted that:

1. independent Claim 26 is patentable;

2. each of dependent Claims 2 - 23 and 25 is individually and separately patentable; and

3. none of Claims 2 - 26 stand or fall together.

The sole Ground of Rejection is a rejection under 35 U.S.C. 103(a) in view of U.S. Patent No. 2,717,867 (Jewell et al).

(a) U.S. Patent No. 2,717,867 (Jewell et al)

Jewell et al is directed at an improved process for hydrocarbon conversion which involves a coking treatment performed in a drum (19), as shown in Figures 1 - 3, which maintains "a fluidized bed of coke." Further, the coking treatment involves contacting a preheated oil with hot finely divided coke in a "coking zone." (Column 2, lines 45 - 53 of Jewell et al). However, as discussed in detail below, the contacting of the oil and the coke within the coking zone takes place PRIOR to the introduction of the oil/coke mixture into the fluidized bed.

Column 3, lines 35 - 41 of Jewell et al states:

> "The hot finely divided coke **and** the preheated residual oil are discharged into the right hand end of the drum 19, preferably at a point **substantially above** the upper surface of the **fluid bed** of coke, under conditions such that the relatively vaporizable portion of the oil is rapidly vaporized and the unvaporizable portion is absorbed by the hot coke particles being introduced into drum 19."

Thus, as shown in Figures 1 - 3 of Jewell et al, the coke particles and the oil are discharged into the drum together to permit their contact above the surface of the fluid bed in order to provide for an initial vaporization of a portion of the oil. Following the initial contact between the coke particles and the oil, the remaining unvaporized oil is absorbed by the coke particles and the **combination or mixture of the coke particles and absorbed oil** falls into the fluid bed.

As further stated at Column 3, lines 42 - 48 of Jewell et al, "the relative proportions of oil and hot coke charged to drum 19 are controlled to provide sufficient absorbent surface in relation to the unvaporized portion of the oil, whereby the latter may be absorbed by the coke while the coke remains sufficiently dry that it can be fluidized by the aerating and stripping gas flowing upwardly through distribution plate 20." In other words, the particles of coke are

fluidized following the absorption of the oil thereby. The coke particles are not fluidized prior to contacting the oil.

Furthermore, with reference to the preferred embodiment of Jewell et al shown in Figures 1 - 3, Column 3, lines 58 - 74 of Jewell et al states:

> "Preferably, the temperatures of the hot coke and oil charged into drum 19 and the relative proportions of each are controlled to effect rapid vaporization of the oil and absorption of unvaporized constituents, **whereby little or no liquid oil falls on the upper surface of the fluid bed of coke**. This may be effected by discharging hot finely divided coke in an aerated condition into the interior of drum 19 at a high point therein while simultaneously spraying the hot residual oil into the interior of drum 19 at a point nearby the point at which the aerated coke is being introduced. The spray of oil is **directed into** the aerated mass of coke being introduced, **to effect intimate contact of the hot coke and oil**. This produces rapid vaporization of a portion of the oil and the unvaporized portion is absorbed by the coke which is settled onto the upper surface of the fluid bed of coke distribution plate 20."

In addition, the intimate contact of the hot oil and coke, or mixing of the hot oil and coke, is preferably achieved in a separate confined zone, referred to as the "vaporizing section" of the coking zone, "whereby part of the oil is vaporized and the unvaporized remainder is substantially completely absorbed by the hot coke, prior to discharge of the resulting mixture into drum 19 at a point from which the coke particles may settle onto the fluidized bed of coke." (Column 3, line 75 - Column 4, line 7 of Jewell et al)

The separate confined zone may be provided outside the drum (19). However, preferably, the separate confined zone is provided in the upper interior of the drum (19) by partitioning off a space around the inlets for the oil and coke. Referring to Figures 1 and 2, a partition is provided in the form of a truncated cone (24). (Column 4, lines 7 - 14 of Jewell et al). Column 4, lines 12 - 26 of Jewell et al states:

> "... a partition in the form of a truncated cone 24, open at the lower small end, is attached to the upper interior wall of drum 19. Line 17 connects with a spray head 25 mounted at the top of drum 19 and arranged to spray the hot residual oil downwardly within the vaporizing section, of the coking zone, defined by partition 24. The finely divided hot coke for the coking treatment is supplied from standpipe 26 as an aerated mass. ... The hot

> finely divided coke from standpipe 26 is discharged into the mixing section of the coking zone provided by partition 24 and into intimate contact with the oil being sprayed therein."

In order to assist in the mixing of the hot coke and oil within the vaporizing section of the coking zone, an extraneous gas may be directly introduced into the mixing section, such as through line (29). The tangential introduction of the extraneous gas from line (29) through inlets (30) produces a swirling movement of the coke particles and oil droplets whereby there is intimate contact of the oil and hot coke within the vaporizing section and prior to discharge of the resulting mixture of oil vapors and hot coke, through the exit (31) of the partition (24). Referring to Figure 3 of Jewell et al, the tangential inlets (30) are oriented horizontally to impart the swirling movement. (Column 4, lines 34 - 46 of Jewell et al).

As indicated above, the contact between the oil and coke particles is performed in a manner such that "little or no liquid oil falls on the upper surface of the fluid bed." This express feature of the process of Jewell et al is further confirmed at Column 4, lines 53 - 58 as follows:

> "It is preferred that vaporization of oil and absorption of the residue shall be accomplished solely by the coke with which the oil is first contacted in the mixing zone and that substantially no unabsorbed liquid oil be precipitated onto the surface 21 of the coke bed."

(b) Acknowledgement of Examiner

On page 4 of the Final Office Action dated October 5, 2009, the following acknowledgement is made by the Examiner:

> "Jewell does not disclose "introducing the liquid feed material *directly* to the fluid bed ... at a feed zone located between the upstream horizontal position and the downstream horizontal position"."
>
> As noted above, these limitations are explicitly claimed in independent Claim 26.

Notwithstanding this acknowledgement, the Examiner has indicated as follows on pages 4 and 5 of the Final Office Action:

1. "Therefore, Examiner finds Applicant's limitation specifying introduction of the liquid feed material "directly" to the fluidized bed to be of no patentable consequence because Jewell does explicitly disclose introducing the liquid feed material "directly" into an aerated mass of solid particles. Examiner notes that a fluidized bed is no more than a fluidized (or aerated) mass of solid particles. Thus, Examiner is unable to discern any patentable distinction over Jewell with respect to Applicant's recitation for "direct" introduction of the liquid feed material into the "fluidized bed"."

2. "Finally, Examiner finds Applicant's limitation specifying introduction of the liquid feed material at a (separate) location between an upstream horizontal position and a downstream horizontal position to be of no patentable consequence because the mere rearrangement of parts of a prior art device generally cannot serve as the basis for establishing patentability in the absence of new or unexpected results (see MPEP § 2144.04(VI)(C)). In this regard, Examiner notes that Jewell discloses wherein the liquid feed material (17) is introduced at a feed zone location that is located between the foremost upstream end of the fluidized bed and the foremost downstream end of the fluidized bed (see Jewell, Fig. 2)."

It is respectfully submitted that the claimed feature "introducing the liquid feed material *directly* to the fluid bed, *separately* from the solid particles ... at a feed zone located between the upstream horizontal position and the downstream horizontal position ..." represents a fundamental distinction between the Applicant's invention and the teachings of Jewell et al, which feature is not rendered unpatentable by the teachings of Jewell et al and which is of patentable consequence.

This fundamental distinction and its technical significance are described in the remarks which follow.

(c) Technical Significance - Exhibits

Exhibit 1 provides, in Section 4.2.3, an overview of coking processes used in petroleum refining, including fluid coking (pages 179-184), Flexicoking^{TM} (pages 184-186), and moving bed or LR coking (pages 186-188). Exhibit 1 provides, in Section 5.3.5, a description of design elements for fluid coking units. Of particular note is the description in the first three paragraphs on page 269, which state as follows:

"Backmixing that occurs in the dense phase fluidized bed is very intensive and the reactor and coke burning bed approach a perfectly mixed reactor. Kinetic calculations must take this into account.

Backmixing also has as a result the homogenization of the temperature inside the dense phase fluidized bed. The difference between different points of the bed does not exceed 1-2°C.

The reactor and the heater in coking and flexicoking plants use dense phase fluidized beds…"

Exhibit 2 provides, in Section 4-7, a comparison of stirred-tank (i.e., well mixed flow) and tubular-flow (i.e., plug flow) reactors. Of particular note are Figure 4-15 and Figure 4-16, and the accompanying description of these Figures on pages 184-186. As indicated in Figure 4-15, longer residence times (i.e., greater reactor volumes) are required for a stirred-tank reactor to achieve a conversion rate which is comparable to a tubular-flow reactor, and conversion rates exceeding about 80 percent are not easily achieved with stirred-tank reactors. As indicated in Figure 4-16 and described on page 185, at conversions of 70 percent or larger, more than twice as much reactor volume is required for a stirred-tank unit than for a tubular-flow unit.

Exhibit 3 provides, in Section 1.4, an overview of continuous-flow reactors, including continuous-stirred tank reactors (Section 1.4.1 on pages 10-11), and tubular reactors (Section 1.4.2 on pages 11-15). Exhibit 3 provides, in Chapter 2 (pages 28-37), an overview of design elements for both continuous-stirred tank reactors and tubular reactors. Of particular note is Section 2.3 (pages 33-37), which provides examples for sizing both a continuous-stirred tank reactor and a tubular reactor, and which demonstrates in Figure E2-1.1, Figure 2.2 and the accompanying description of these Figures on pages 34-36 the increased reactor size as a function of conversion for a continuous-stirred tank reactor in comparison with a tubular reactor.

Exhibit 4 provides, in Chapter 9, an overview of mixing characteristics in fluid beds. Of particular note are Example 1 (page 218) relating to the determination of a vertical dispersion coefficient (D_{sv}) in a shallow coarse particle bed, and pages 220-222 relating to the determination of a horizontal dispersion coefficient (D_{sh}) in a fine particle bed of fast rising bubbles. As can be seen, the values for D_{sv} on page 218 have an order of magnitude of 10^{-1}, while the values for D_{sh} on page 220 have an order of magnitude of 10^{-3}, illustrating that vertical mixing in a fluid bed occurs at a much higher rate than does horizontal mixing.

Exhibit 5 provides (in a paper written by the Applicants) a description of the features and advantages of the Applicants' invention as claimed in independent Claim 26 in comparison with fluid coking and delayed coking processes, in the context of many of the principles which are documented in the Exhibits.

Exhibit 6 provides an illustration of the effect of operating temperature of a continuous coking process upon the yield and quality of liquid products produced by the process. Of particular note is Table 2 and the accompanying description on page 202 which indicates that the production of non-liquid products, including both coke and non-condensable gases (i.e., C_3 and lighter) decreases as the operating temperature is reduced, resulting in a corresponding increase in the production of gasoline and gas oil (i.e., liquid) products.

Exhibit 7 provides an overview of the fluid coking process and the Flexicoking™ process in comparison with the delayed coking process.

Exhibit 8 provides an overview of the Flexicoking™ process as performed at Esso Rotterdam.

Exhibit 9 provides an overview of the delayed coking process, which is NOT a fluid bed process but which is referred to in other Exhibits. Exhibit 9 is therefore included solely to provide background for the delayed coking process in the context of the references in the other Exhibits to the delayed coking process.

(d) Technical Significance - Plug Flow and Well Mixed Flow

Referring to Exhibits 2-3 and Exhibit 5, in chemical engineering terms, "plug flow" is a term which is used to describe movement of a fluid in which there is no back-mixing between the individual components of the fluid. In the context of a plug flow fluid bed reactor, plug flow exists where each discrete volume of fluidized solids or "plug" which is introduced into the feed end of the reactor passes through the reactor to the outlet end with no mixing with the discrete volumes of fluidized solids or plugs which are upstream or downstream. As a result, all of the material in a particular plug which is introduced into a plug flow fluid bed reactor will spend

exactly the same time in the reactor and will be subjected to exactly the same conditions while passing through the reactor.

In contrast, and referring to Exhibits 1-3 and Exhibit 5, "well mixed flow" is a term which is used to describe movement of a fluid in which the back-mixing between the individual components of the fluid is complete and fully efficient. In the context of a well mixed fluid bed reactor (such as a continuous stirred tank reactor or "CSTR"), well-mixed flow exists where all of the material which is introduced into the reactor is instantaneously mixed completely with the material which is already present in the reactor. As a result, not all of the material which is introduced into a well mixed fluid bed reactor will spend the same amount of time in the reactor, since a significant fraction will exit the reactor immediately upon being introduced into the reactor.

In well mixed flow, each discrete volume of fluidized solids which is introduced into the reactor is instantaneously mixed with each of the other discrete volumes of fluidized solids which are present in the reactor so that the contents of the entire reactor are homogeneous. In plug flow, each discrete volume or plug of fluidized solids which is introduced into the reactor becomes well mixed so that each plug is homogeneous, but adjacent plugs are not mixed with each other.

Well mixed flow occurs when the rate of mixing of fluidized solids in a reactor is high relative to the rate of passage of the fluidized solids through the reactor. Referring to Exhibit 4, the rate of mixing in a fluid bed in the vertical direction is typically several orders of magnitude higher than the rate of mixing in a fluid bed in the horizontal direction.

Well mixed flow may therefore be associated with reactors in which the fluidized solids move vertically through the reactor, since this vertical movement will encourage vertical mixing between adjacent volumes of fluidized solids. Well mixed flow may also be associated with other reactor configurations where intimate mixing of the fluidized solids is promoted. In contrast, plug flow may be associated with reactors in which the fluidized solids move horizontally through the reactor, so that mixing between adjacent volumes of fluidized solids is minimized.

Hydrocarbon thermal upgrading processes based upon well mixed flow type fluid bed reactors are known. One particular such process is the "fluid coking" process, which is described at page 3, line 33 to page 5, line 20 of the Specification, and in Exhibit 1, Exhibit 5 and Exhibits 7-8. The related Flexicoking™ process is described in Exhibit 1 and in Exhibits 7-8.

In the fluid coking process and the Flexicoking™ process, a vertically oriented fluid bed reactor is used so that the fluidized solids move vertically through the reactor (see Exhibit 1, Figure 4.25; Exhibit 7, pages 8 and 14; Exhibit 8, page 12). Solid particles are introduced into the reactor in the freeboard region above the fluid bed and are removed from the bottom of the reactor. Liquid feed material is sprayed into the fluid bed at several different elevations where it coats the fluidized solid particles. The nature of vertical solids movement and mixing in the fluid bed leads to generally well mixed conditions. As a result, some solid particles and thus some liquid feed material will "short circuit" the reactor and thus be removed from the reactor immediately, while other solid particles and thus some liquid feed material will spend a very long time at reactor conditions.

A consequence of "short circuiting" in a well mixed flow type fluid bed reactor is that a portion of the liquid feed material is lost with no liquid products (i.e., products which are a liquid at ambient temperature and pressure) being derived therefrom.

To minimize such losses, and as described in Exhibits 2-3 and Exhibit 5, the reactor volume may be increased substantially in order to dilute the incoming liquid feed material, thereby increasing the average residence time of the liquid feed material in the reactor and reducing losses. In commercial applications, a fluid coking reactor is typically sized at approximately 15-20 times larger than would be required if the reactor did not produce well mixed conditions.

Alternatively or additionally, the operating temperature of the reactor may be increased in order to increase the rate at which conversion (i.e., reaction) of the liquid feed material occurs. However, as described in Exhibit 6, increasing the operating temperature will result in reduced yield of liquid products from the liquid feed material and reduced quality of the liquid products which are produced.

As a result, in designing a well mixed flow type fluid bed reactor, a balancing act must be performed to seek an acceptable compromise between the processing capacity of the reactor and the yield and quality of the liquid products which are produced in the reactor.

In hydrocarbon upgrading applications, fluid bed reactors are typically sized to provide a target conversion rate of at least 99 percent of the liquid feed material. Because of the limitations described above which are associated with well mixed flow type fluid bed reactors, a well mixed flow type fluid bed reactor which is the same size as a plug flow type reactor capable of achieving a 99 percent target conversion rate will experience significant losses of unreacted liquid feed material so that the actual conversion rate of the well mixed flow type fluid bed reactor will be well below the target conversion rate. To compensate, the designer of a well mixed flow type fluid bed reactor has three options.

The first option is to increase the size of the well mixed flow type fluid bed reactor by up to 20 times in order to provide more time for reactions to occur in the reactor, which will result in significantly increased capital cost.

The second option is to increase the speed of the reactions which occur in the well mixed fluid bed reactor by increasing the operating temperature of the reactor. However, as mentioned above, increasing the operating temperature of the reactor will reduce both the yield of liquid products produced from the liquid feed material and the quality of the liquid products which are produced from the liquid feed material.

The third option is to increase both the size and the operating temperature of the well mixed flow type fluid bed reactor in order to achieve an acceptable compromise between the capital cost of the reactor and the yield and quality of the liquid products.

With any of the three options described above, the limitations associated with a well mixed flow type fluid bed reactor result in design constraints in a hydrocarbon upgrading process which can be reduced or eliminated if a plug flow type fluid bed reactor is used.

In particular, a plug flow type fluid bed reactor can be sized and operated to achieve a desired capacity or throughput of the reactor, and an operating temperature of a plug

flow type fluid bed reactor can be selected to optimize the yield and quality of the liquid products which are produced from the liquid feed material, without consideration of the effects and consequences of back-mixing.

(e) Independent Claim 26 and Jewell et al

As described above, Jewell et al describes a two stage coking process which is carried out on a preheated residual liquid oil from a fractionating tower (15).

In the first stage of the coking process, hot coke particles are mixed with the preheated residual liquid oil in a vaporizing section of a coking zone, under conditions such that the relatively vaporizable portion of the residual oil is rapidly vaporized and the unvaporizable portion is absorbed by the hot coke particles (Column 3, lines 35 - 41 of Jewell et al).

In the second stage of the coking process, the hot coke particles containing absorbed residual hydrocarbons from the vaporizing section are introduced into a soaking section of the coking zone, which includes a drum (19) containing a fluid bed (21) so that the coke particles are precipitated onto the fluid bed (21) (Column 5, lines 14 - 24 of Jewell et al). Sufficient residence time of the coke particles is provided in the fluid bed (21) to complete the coking of the residual hydrocarbons which are absorbed onto the coke particles (Column 5, lines 35 - 40 of Jewell et al).

The first stage of the coking process (i.e., the vaporizing section of the coking zone) is described extensively at Column 3, line 35 to Column 5, line 13 of Jewell et al, and is interchangeably referred to as the "mixing and absorbing zone" (Column 4, line 8 of Jewell et al), the "mixing section" (Column 4, line 24; Column 4, lines 36 - 37; and Column 4, line 39 of Jewell et al), the "mixing zone" (Column 4, line 56 of Jewell et al), the "mixing and vaporizing zone" (Column 4, line 74 of Jewell et al) and the "confined mixing zone" (Column 5, lines 8 - 9 of Jewell et al). The vaporizing section of the coking zone is also depicted in Figure 3 of Jewell et al.

The hot coke particles are introduced into the upper end of the vaporizing section partition (24) through branch lines (28). The residual oil is introduced into the upper end of the vaporizing section partition (24) through line (17) and spray head (25), and the spray of the

residual oil is directed into the hot coke particles to "effect intimate contact" of the hot coke and oil (Column 3, line 70; and Column 4, lines 25 -2 6 of Jewell et al). The vaporizing zone is configured to "promote intimate mixing" of the hot coke particles and the residual oil (Column 4, line 27 of Jewell et al). The "mixing" of the hot coke particles and the residual oil within the vaporizing section of the coking zone may be assisted by introducing extraneous gas directly into the "mixing section" (Column 4, lines 34 - 37 of Jewell et al), producing a "swirling movement" of the hot coke particles and the residual oil droplets whereby there is "intimate contact" of the hot coke particles and the residual oil within the vaporizing section (Column 4, lines 41 - 44 of Jewell et al).

The hot coke particles with residual hydrocarbons absorbed thereon are removed from the vaporizing section partition (24) via exit (31) which is located at the bottom of the vaporizing section partition (24).

The second stage of the coking process is described extensively at Column 5, line 14 to Column 6, line 30 of Jewell et al. The soaking section of the coking zone is depicted in Figure 1 and Figure 2 of Jewell et al. The hot coke particles with residual hydrocarbons absorbed thereon are precipitated upon the fluid bed (21) after being discharged from the exit (31) of the vaporizing section partition (24). The fluid bed (21) of coke particles moves laterally toward a withdrawal passageway (32), providing a uniform residence time of the coke particles in the fluid bed, thereby facilitating a completion of the coking of the residual hydrocarbons which are absorbed on the hot coke particles.

Based upon both the geometry and the manner of operation of the vaporizing section (i.e., mixing section) and the soaking section, it is submitted that the two stage coking process described in Jewell et al consists of a first stage which is performed in a well mixed flow type fluid bed reactor (24) and a second stage which is performed in a plug flow type fluid bed reactor (21).

Referring to page 3, line 33 to page 5, line 20 of the Application, it is therefore respectfully submitted that Jewell et al is essentially directed at a fluid coking process as described therein which includes initial processing in a well mixed flow type fluid bed reactor followed by processing in a stripping section which includes a plug flow type fluid bed reactor.

As a result, the process described in Jewell et al will be subject to the same limitations as other processes (such as the fluid coking process) which are conducted in a well mixed flow type fluid bed reactor. Specifically, the vaporizing section partition (24) will need to be greatly oversized in order to limit the amount of liquid feed material which is lost to short circuiting and/or the operating temperature of the vaporizing section will need to be increased in order to increase the reaction speed. In any case, a compromise will be required between the capital cost of the reactor and the yield and quality of the liquid products obtained from the liquid feed material.

In other words, the vaporizing section (i.e., mixing section) in Jewell et al represents a "bottleneck" in the coking process described in Jewell et al.

The limitations of the process described in Jewell et al are further exacerbated by the requirement in Jewell et al that the hot coke particles which are discharged from the exit (31) of the vaporizing section partition (24) must be "sufficiently dry" so that they can be fluidized by the aerating and stripping gas in the fluid bed (21) (Column 3, lines 42 - 48 of Jewell et al) and by the requirement that the hot coke particles "remain in a relatively dry non-adhering condition" in which they may be maintained as a dense free-flowing, fluidized mass in the fluid bed (21) (Column 4, lines 47-53 of Jewell et al).

It is respectfully submitted that in order for relatively dry non-adhering coke particles to be produced in the vaporizing section of the coking zone in Jewell et al, a very high conversion rate of the liquid feed material must be achieved in the vaporizing section. As a result, the requirement in Jewell et al that "dry" hot coke particles be produced in the vaporizing section will serve as an additional limitation affecting the design of the vaporizing section in Jewell et al, and will result in further difficulty in achieving an acceptable compromise between the capital cost of the reactor and the yield and quality of the liquid products produced from the liquid feed material.

In contrast, the Applicant's process as claimed in independent Claim 26 does not include processing in a well mixed flow type fluid bed reactor. This is evident or inherent from

the steps of the Applicant's claimed process and the claimed geometry or configuration of the apparatus, including the fluid bed, in which the process is conducted.

Instead, in the Applicant's claimed process, the liquid feed material is introduced directly to a plug flow type fluid bed and separately from the solid particles so that the residence time of all of the liquid feed material in the reactor can be carefully controlled, thereby facilitating a lower operating temperature in the reactor (resulting in increased yield and quality of liquid products) and a smaller reactor size in comparison with the reactor required in Jewell et al.

It is therefore respectfully submitted that the following limitation:

> "Jewell does not disclose "introducing the liquid feed material *directly* to the fluid bed...at a feed zone located between the upstream horizontal position and the downstream horizontal position." (Page 4 of the Final Office Action)

as explicitly claimed in independent Claim 26 <u>IS</u> of patentable consequence because of the inherent limitations of the vaporizing section of the process of Jewell et al which are not present in the process which is explicitly claimed in independent Claim 26.

Furthermore, it is submitted that Jewell et al fails to teach, describe or suggest several features of the Applicant's claimed process which provide critical differences between the Applicant's process and Jewell et. al.

As discussed in *KSR International Co. v. Teleflex Inc.,* 82 USPQ2d 1385 (2007), the determination of obviousness under 35 U.S.C. 103 is a legal conclusion based on factual evidence. The legal conclusion that a claim is obvious depends upon at least four underlying factual issues, as set forth in *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966): (1) the scope and content of the prior art; (2) <u>differences between the prior art and the claims at issue</u>; (3) the level of ordinary skill in the pertinent art; and (4) evaluation of any relevant secondary considerations.

Therefore, it is submitted that the test for obviousness must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the

combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 227 USPQ 543 (Fed. Cir. 1985); *Manual of Patent Examining Procedure* §2143.02. The Examiner must, as one of the inquiries pertinent to any obviousness inquiry under 35 U.S.C. 103 recognize and consider not only the similarities but also the critical differences between the claimed invention and the prior art. *In re Bond,* 15 USPQ2d 1566 (Fed. Cir. 1990). Moreover, the Examiner must avoid hindsight.

As indicated, Jewell et al does not teach, describe or suggest in any manner several of the features of the Applicant's process, which provide critical differences between the Applicant's process and that of Jewell et al.

Specifically, as discussed above, Jewell et al does not disclose or suggest in any manner the feature "...introducing the liquid feed material **directly** to the fluid bed, **separately from the solid particles** and separately from the fluidizing medium, at a feed zone located between the upstream horizontal position and the downstream horizontal position in order to facilitate the conversion of the liquid feed material into the vapor phase product" as claimed in independent Claim 26.

Further, Claim 26 claims the feature "...wherein providing the fluid bed is comprised of introducing the solid particles to the fluid bed at an upstream horizontal position in the fluid bed...". Thus, pursuant to Claim 26, the "upstream horizontal position" is the position at which the solid particles are introduced to the fluid bed. Consequently, the feature "...introducing the liquid feed material...at a feed zone located between the upstream horizontal position and the downstream horizontal position..." clearly provides that the liquid feed material is introduced to the fluid bed at a location which is downstream from the location at which the solid particles are introduced to the fluid bed.

It is therefore respectfully submitted that independent Claim 26 is not unpatentable under the Ground of Rejection because the cited reference does not describe or suggest all of the features of independent Claim 26 and because these features provide critical distinctions from the cited reference which are of patentable consequence.

(f) Dependent Claims 2 - 23 and 25

Dependent Claims 2 - 6

Claims 2 to 6 further define the step of collecting the vapor phase product and the regeneration of the solid particles after the collecting step. Claims 2 to 6 depend directly or indirectly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claims 2 to 6 are also patentable over Jewell et al.

Dependent Claims 7 - 8

Claims 7 and 8 further define the step of moving the solid particles in the substantially horizontal solid transport direction. Claims 7 and 8 depend directly or indirectly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claims 7 and 8 are also patentable over Jewell et al.

Dependent Claim 9

Claim 9 further defines the step of providing the fluid bed. Claim 9 depends directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claim 9 is also patentable over Jewell et al.

Dependent Claims 10 - 14

Claim 10 depends from independent Claim 26 and further defines the step of "introducing the liquid feed material directly to the fluid bed at the feed zone" as being "comprised of spraying the liquid feed material so that the liquid feed material contacts the solid particles as droplets."

As described previously, the liquid feed material of the Applicant's process is introduced directly to the fluid bed, separately from the solid particles, at the feed zone. Thus,

pursuant to Claim 10, the liquid feed material is sprayed directly into the fluid bed at the feed zone.

In contrast, Jewell et al does not spray the liquid feed material (oil) directly into the fluid bed, but rather, sprays the liquid feed material onto the solid particles (coke particles) above the fluid bed, prior to introduction to the fluid bed. Furthermore, the tangential inlets (30) introduce an extraneous gas into the mixing section, which produces a swirling movement of the coke particles and the oil droplets, further inhibiting or preventing the oil droplets from being introduced directly to the fluid bed.

Claim 11 depends from Claim 10 and further claims "wherein the liquid feed material is sprayed within the fluid bed so that the droplets penetrate the fluid bed."

It is submitted that Jewell et al specifically teaches away from this feature. As discussed above, the intent of Jewell et al is to vaporize or absorb all of the oil upon contact with the coke particles "whereby little or no liquid oil falls on the upper surface of the fluid bed of coke."

Claims 12 to 14 depend directly or indirectly from Claim 10 and further define a spraying direction of the droplets of the liquid feed material.

Claim 12 claims "wherein the liquid feed material is sprayed so that the droplets contact the solid particles from a spraying direction which is substantially perpendicular to the solid transport direction." The "solid transport direction" is defined by the Applicant in Claim 26 as the direction of movement of the solid particles in the fluid bed.

Claim 13 claims "wherein the spraying direction is a substantially vertical direction." Claim 14 claims "wherein the spraying direction is substantially opposite to the fluidizing direction." The "fluidizing direction" is defined by the Applicant in Claim 26 as the direction of introducing the fluidizing medium to the fluid bed.

As indicated, Jewell et al does not spray the liquid feed material into the fluid bed, but rather into a vaporizing section above the fluid bed. Thus, Jewell et al does not describe or suggest in any manner the direction of spray of the liquid feed material directly into the fluid bed.

Finally, Claims 10 - 14 depend directly or indirectly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claims 10 - 14 are also patentable over Jewell et al.

Dependent Claim 15

Claim 15 defines the process as further comprising the step of quenching the vapor phase product. Claim 15 depends directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claim 15 is also patentable over Jewell et al.

Dependent Claims 16 - 17

Claims 16 and 17 define the process as further comprising the step of collecting the fluidizing medium, and separating the collected fluidizing medium. Claims 16 and 17 depend directly or indirectly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claims 16 and 17 are also patentable over Jewell et al.

Dependent Claim 18

Claim 18 claims "wherein the solid particles are moved in the solid transport direction at a rate which is significantly larger than a rate of mixing of the solid particles in the solid transport direction." Claim 18 depends directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claim 18 is also patentable over Jewell et al.

In addition, as described above, preferably the Applicant's process provides for "the solid particles (28) to move along the length of the reactor (20) in uniform plugs that are well

mixed in the radial direction. Since every solid particle (28) has the same horizontal velocity, there can be no mixing along the length of the reactor (20)." Thus, the solids residence time distribution "approaches the plug-flow ideal since the bulk rate of solids flow along the length of the fluid bed (30) is much larger than the rate of solids mixing in the same direction."

It is respectfully submitted that although Jewell et al may discuss varying the solids residence time in the drum, Jewell et al provides limited guidance or direction regarding the desired residence time to be achieved. Specifically, Jewell el al simply states that the "time of residence of the coke particles in the fluid bed in drum 19 is sufficient to provide the soaking time required to complete the coking of the residual hydrocarbons deposited on the coke particles and the evolution of hydrocarbons released by the coking reaction" (Column 5, lines 35 - 39 of Jewell et al).

<u>Dependent Claims 19 - 21</u>

Claims 19 to 21 further define the liquid feed material. Claims 19 to 21 depend directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claims 19 to 21 are also patentable over Jewell et al.

<u>Dependent Claim 22</u>

Claim 22 further defines the solid particles as being comprised of "<u>an amount of a catalyst</u> which is suitable for use in converting the liquid feed material into the vapor phase product." Claim 22 depends directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claim 22 is also patentable over Jewell et al.

Further, it is submitted that Jewell et al does not discuss in any manner the solid particles being <u>comprised of a catalyst</u>. In this regard, the Examiner refers to Column 1, lines 46 - 49 and Column 5, lines 14 - 24 and 36 - 40 of Jewell et al. However, upon reviewing these portions of Jewell et al, it is submitted that Jewell et al does not discuss the use of a catalyst.

As well, the Examiner states that "the hot particles of Jewell act as a catalyst in the coking reaction and conversion of the liquid feed material into vapor phase product." Thus, the Examiner states that the hot particles act as the catalyst. However, the "hot particles" referred to by the Examiner are in fact the "solid particles." Accordingly, it appears that the Examiner is indicating that the solid particles act as their own catalyst, or that no catalyst is required as the hot particles are sufficient on their own. In either event, it is submitted that Jewell et al does not teach the solid particles being comprised of an amount of a catalyst.

Dependent Claim 23

Claim 23 further defines the step of collecting the vapor phase product. Claim 23 depends directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claim 23 is also patentable over Jewell et al.

Dependent Claim 25

Claim 25 defines the process as further comprising "the step of collecting a vaporized fraction of the liquid feed material at a vapor phase product collection location which is adjacent to the feed zone." Claim 25 depends directly from independent Claim 26, which the Applicant has shown to be patentable over Jewell et al. For at least this reason, it is submitted that dependent Claim 25 is also patentable over Jewell et al.

Further, in the Applicant's claimed process, the liquid feed material (40) is converted into the vapor phase product (44) and the vapor phase product (44) is collected by the vapor collection apparatus (46), as shown in Figure 1. Further, a vaporized fraction (51) of the liquid feed material is collected at a vapor phase collection location (50). The vapor phase collection location (50) is adjacent the feed zone (62), being the location at which the liquid feed material (40) is introduced directly into the fluid bed (30).

It is submitted that Jewell et al does not disclose or suggest a vapor phase product collection location which is adjacent to the feed zone. The Examiner refers to vapor product outlet lines (49) of Jewell et al as disclosing this feature. However, the outlet lines (49) for the drum

(19) are spaced along the length of the drum (19) for removing the "volatile products of the process" (Column 9, lines 17 - 24 of Jewell et al). Accordingly, the lines (49) are not adjacent the "feed zone" for the liquid feed material. Further, the lines (49) are provided for the "vapor phase product" and not a "vaporized fraction of the liquid feed material."

(g) Conclusions

For the reasons set out above, it is respectfully submitted that the Examiner's rejection of Claims 2 - 23, 25 and 26 in the Final Office Action dated October 5, 2009 was erroneous and a reversal of the Examiner's decision in the Final Office Action is respectfully requested.

More specifically, it is respectfully submitted that independent Claim 26 is patentable, and allowance of independent Claim 26 is respectfully requested.

Dependent Claims 2-25 all depend directly or indirectly from independent Claim 26. It is further respectfully submitted that dependent Claims 2-25 are patentable on the basis of the distinctions defined therein and on the basis of the patentability of independent Claim 26. Allowance of dependent Claims 2-25 is therefore also respectfully requested.

Respectfully submitted,

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8. CLAIMS APPENDIX

1. (Cancelled)

2. (Previously Presented) The process as claimed in claim 26, further comprising the step of collecting the solid particles.

3. (Previously Presented) The process as claimed in claim 2 wherein the step of collecting the solid particles is comprised of collecting the solid particles at the downstream horizontal position.

4. (Original) The process as claimed in claim 3, further comprising the step of regenerating the solid particles for re-use after collecting the solid particles.

5. (Original) The process as claimed in claim 4 wherein the step of regenerating the solid particles is comprised of heating the solid particles.

6. (Original) The process as claimed in claim 5 wherein the step of regenerating the solid particles is comprised of heating the solid particles to the conversion temperature.

7. (Previously Presented) The process as claimed in claim 26 wherein the step of moving the solid particles in the substantially horizontal solid transport direction consists essentially of moving the solid particles under the influence of gravity.

8. (Original) The process as claimed in claim 7 wherein the upstream horizontal position is at a higher elevation than the downstream horizontal position so that the solid particles move in the solid transport direction from the upstream horizontal position to the downstream horizontal position under the influence of gravity.

9. (Previously Presented) The process as claimed in claim 26 wherein the step of providing the fluid bed is comprised of introducing the fluidizing medium to the fluid bed at a lower vertical position below the solid particles so that the fluidizing direction is substantially upward.

10. (Previously Presented) The process as claimed in claim 26 wherein the step of introducing the liquid feed material directly to the fluid bed at the feed zone is comprised of spraying the liquid feed material so that the liquid feed material contacts the solid particles as droplets.

11. (Original) The process as claimed in claim 10 wherein the liquid feed material is sprayed within the fluid bed so that the droplets penetrate the fluid bed.

12. (Original) The process as claimed in claim 10 wherein the liquid feed material is sprayed so that the droplets contact the solid particles from a spraying direction which is substantially perpendicular to the solid transport direction.

13. (Original) The process as claimed in claim 10 wherein the spraying direction is a substantially vertical direction.

14. (Original) The process as claimed in claim 13 wherein the spraying direction is substantially opposite to the fluidizing direction.

15. (Previously Presented) The process as claimed in claim 26, further comprising the step of quenching the vapor phase product after collecting the vapor phase product in order to minimize further conversion of the vapor phase product.

16. (Previously Presented) The process as claimed in claim 26, further comprising the step of collecting the fluidizing medium with the vapor phase product at an upper vertical position above the solid particles.

17. (Original) The process as claimed in claim 16, further comprising the step of separating the fluidizing medium and the vapor phase product after collecting the fluidizing medium and the vapor phase product.

18. (Previously Presented) The process as claimed in claim 26 wherein the solid particles are moved in the solid transport direction at a rate which is significantly larger than a rate of mixing of the solid particles in the solid transport direction.

19. (Previously Presented) The process as claimed in claim 26 wherein the liquid feed material is comprised of liquid hydrocarbon.

20. (Previously Presented) The process as claimed in claim 26 wherein the liquid feed material is comprised of a heavy hydrocarbon.

21. (Previously Presented) The process as claimed in claim 26 wherein the liquid feed material is comprised of heavy oil or a heavy fraction of a crude oil.

22. (Previously Presented) The process as claimed in claim 26 wherein the solid particles are comprised of an amount of a catalyst which is suitable for use in converting the liquid feed material into the vapor phase product.

23. (Previously Presented) The process as claimed in claim 26 wherein the step of collecting the vapor phase product is comprised of collecting the vapor phase product at a plurality of vapor phase product collection locations spaced horizontally between the upstream horizontal position and the downstream horizontal position.

24. (Original) The process as claimed in claim 23 wherein the vapor phase product has a composition and wherein the composition of the vapor phase product varies amongst the vapor phase product collection locations.

25. (Previously Presented) The process as claimed in claim 26, further comprising the step of collecting a vaporized fraction of the liquid feed material at a vapor phase product collection location which is adjacent to the feed zone.

26. (Previously Presented) A process for converting a liquid feed material into a vapor phase product comprising the following steps:

(a) providing a fluid bed comprising solid particles and a fluidizing medium, wherein providing the fluid bed is comprised of introducing the solid particles to the fluid bed at an upstream horizontal position in the fluid bed, wherein providing the fluid bed is further comprised of introducing the fluidizing medium to the fluid bed so

that the fluidizing medium is moving in a substantially vertical fluidizing direction, and wherein the solid particles are at a conversion temperature which is suitable for facilitating the conversion of the liquid feed material to the vapor phase product;

(b) moving the solid particles in a substantially horizontal solid transport direction from the upstream horizontal position to a downstream horizontal position;

(c) introducing the liquid feed material directly to the fluid bed, separately from the solid particles and separately from the fluidizing medium, at a feed zone located between the upstream horizontal position and the downstream horizontal position in order to facilitate the conversion of the liquid feed material into the vapor phase product;

(d) maintaining the solid particles as fluidized solid particles in the feed zone by introducing the fluidizing medium to the fluid bed in the feed zone; and

(e) collecting the vapor phase product.

9. EVIDENCE APPENDIX

The Evidence Appendix containing the Exhibits discussed in this Appeal Brief is attached hereto and forms part of this Appellant's Brief.

In particular, the Exhibits which were first entered in the "Response to the Office Action dated December 24, 2008" filed on June 8, 2009 are as follows:

Exhibit 1: Raseev, Serge, "Thermal and Catalytic Processes in Petroleum Refining", Marcel Dekker, Inc., 2003, pages 179-188 (from Chapter 4) and pages 269-274 (from Chapter 5);

Exhibit 2: Smith, J.M., "Chemical Engineering Kinetics", Third Edition, McGraw-Hill Book Company, 1981, pages 182-191 (from Chapter 4);

Exhibit 3: Fogler, H. Scott, "Elements of Chemical Reaction Engineering", Prentice-Hall, Inc., 1986, pages 10-20 (from Chapter 1) and 28-37 (from Chapter 2);

Exhibit 4: Kunii, Daizo, Levenspiel, Octave, "Fluidization Engineering", Second Edition, Butterworth-Heinemann, 1991, pages 211-225 (from Chapter 9);

Exhibit 5: Brown, Wayne, Pinchuk, R., Monaghan, G., "Benefits from Coking of Heavy Feedstocks", Petroleum Technology Quarterly, Vol. 10, No. 4, 2005, pages 85-91;

Exhibit 6: Mekler, Valentine, Schutte, A., Whipple, T.T., "Continuous-Coking Process Shows Ability to Handle Heavy Feed Stocks", The Oil and Gas Journal, November 16, 1953, pages 200-203;

Exhibit 7: Kamienski, Paul, Gorshteyn, Anna, Phillips, Glen, Woerner, Andrew, "Delivering Value for Resid and Heavy Feed", 1st Russia & CIS Bottom of the Barrel Technology Conference, Moscow, April 19, 2005;

Exhibit 8: Rooijmans, Aad, "FLEXICOKING at Esso Rotterdam", dated October 6, 2003, downloaded from the Internet on June 1, 2009 at the following link: http://www.tnw.tudelft.nl/live/pagina.jsp?id=4aeecd0c-d9f3-4bfd-b9b1-27ec3c4a9f1e&lang=en&binary=/doc/exxonmobil_2003.pdf; and

Exhibit 9: Ellis, Paul J., Paul, Christopher A., "Tutorial: Delayed Coking Fundamentals", AIChE 1998 Spring National Meeting, New Orleans, LA, March 8-12, 1998;

10. RELATED PROCEEDINGS APPENDIX

There are no related proceedings, with the result that no decisions of related proceedings are included with this Appellant's Brief.